

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CIVIL ENGINEERING SUPPORT AGENCY

10 JUN 1994

FROM: HQ AFCEA/ENM
139 Barnes Drive Suite 1
Tyndall AFB FL 32403-5319

SUBJECT: Engineering Technical Letter (ETL) 94-2:
Utility Meters in New and Renovated Facilities

1. Purpose. This ETL establishes a mandatory requirement for utility meters in new and renovated base facilities to measure consumption of supplied water, fuel, or energy. These meters measure energy and water used by general purpose (process) buildings, and utilities services reimbursable or refundable by the government or private business. Use of meters will:

- o Establish benchmarks of current energy consumption to help the Base
- o Energy Conservation Committee manage facility energy consumption;
- o Identify high energy and water consumers to help base personnel reduce consumption;
- o Enhance safety of fuel hydrant systems; and
- o Allow response to frequent Congressional inquiries regarding the effectiveness of energy and water analyses through metering.

2. Application.

2.1. Authority. The Code of Federal Regulations (10 CFR 435, Sect 10, Energy Management) and the Energy Policy Act of 1992 (Public Law 102-486, Sect 305), require metering of each distinct utility-provided energy service. This ETL also satisfies requirements of Office of the Secretary of Defense (OSD) Defense Energy Program Policy Memorandum (DEPPM) 92-2, Energy Conservation Investment Program Guidance, 4 March 1992, to validate energy savings.

2.2. Effective Date. This ETL supersedes ETL 87-5, Utility Meters in New and Renovated Facilities, 13 July 1987, and is effective immediately.

3. Specific Requirements. Install meters at all new facilities and each major renovation project. Install additional meters as required to satisfy local environmental monitoring laws. Provide a meter for each energy utility serving the building (steam, high-temperature hot water, electricity, natural gas, fuel oil). Meters will be calibrated in the normal units of the utility [MJ (kWh), L (cf or gal)]. If one form of energy is used to produce a second form (such as natural gas producing steam) used solely within that facility, meter only the primary source at the building boundary.

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NOTE: These meters are for government use only for monitoring and evaluating energy consumption within a facility. They are NOT for utility company billing usage!

3.1. Electric Metering. Measure energy consumed by:

- o Electrical lighting;
- o Miscellaneous power outlets;
- o HVAC systems and equipment;
- o Service hot water; and
- o Process loads

for buildings where combined service exceeds 150 kVA or fuel use exceeds 146,536 W (500,000 Btu/h). Meter the following individually where system consumption exceeds 100 kVA or 87,921 W (300,000 Btu/h):

- o Production processes (manufacturing, computers, laundries, kitchens);
- o Auxiliary systems and service water heating;
- o Space heating (including reheat);
- o Space cooling; and
- o HVAC delivery systems.

Exception: When there is an energy service for only two of the six categories listed, take a single measurement for the larger service, and determine consumption of the smaller service by subtracting the larger service measurement from the primary service measurements.

3.2. Water Metering. Measure water consumption for:

- o All non-appropriated funded facilities which reimburse the government for water usage.
- o All facilities with a boiler plant 879.21 kW (3 MBtu/h) capacity or larger.
- o Facilities that use more than 18,927 liters (5000 gallons) of water per day, including landscape irrigation. These facilities should be addressed on a case-by-case basis and specified in the project definition when this requirement applies.

3.3. Types of Meters.

3.3.1. Watt-hour Meters.

3.3.1.1. Without Demand Registers. Watt-hour meters and sockets must comply with ANSI C12.10 and have pulse initiators for remote monitoring of watt-hour consumption. The pulse initiator will consist of Form C contacts with:

- o Current rating not to exceed 2 amperes (A);
- o Voltage not to exceed 500 volts (V);

- o Volt-amperes (VA) not to exceed 1 00 VA; and
- o Life rating of one billion operations.

3.3.1.2. With Demand Registers. Meters and sockets must comply with ANSI C12.10 and have pulse initiators for remote monitoring of watt-hour consumption and instantaneous demand. Pulse initiators will be as described in paragraph 3.3.1.1.

3.3.2. Water Meters. Meters must conform to American Water Works Association (AWWA) C700 and meet these criteria:

- o positive displacement, oscillating piston, or oscillating disc type;
- o magnetic drive with magnetic shielding;
- o straight reading sealed register graduated in liters (cubic feet);
- o all bronze split case;
- o integral strainer;
- o threaded ends;
- o with pulse switch initiator.

Water meters must be capable of accurately measuring and handling water at pressure, temperatures, and-flow rates encountered. The pulse initiator will provide the maximum number of pulses, up to 500 per minute, obtainable from the manufacturer; and not less than 1 pulse per 378.5 liters (100 gallons).

3.3.3. Gas Meters. Install meters according to 49 CFR 192, Transportation of Natural or Other Gas by Pipeline: Minimum Federal Safety Standards and the Guidance Manual for Operations of Small Gas Systems, U.S. Department of Transportation. Gas meters must conform to the American Gas Association (AGA) standard appropriate for the size and type meter installed. Meters must be capable of providing pulse or digital signals for remote readout. Pulse switch initiators will provide the maximum number of pulses, up to 500 per minute, obtainable from the manufacturer; and not less than 1 pulse per 2.83 cubic meters (100 cubic feet). Meters will have local readout capability and be calibrated in standard cubic meters (cubic feet).

3.3.4. Steam Condensate Meters. Meters must conform to MIL-M-1 8294, Style A or C, size 1. Meters will be designed for 121.1 degrees Celsius (250 degrees Fahrenheit) condensate, and flow rates from 7.6 to 37.8 liters (2 to 10 gallons) per minute. Meters will have a pulse switch initiator capable of 500 pulses per minute with no false pulses; and not less than 1 pulse per 37.8 liters. Meters will not require field adjustments.

3.3.5. Chilled Water Meters. If the facility receives chilled water from a central chilled water plant, install a watt ("Btu") meter. This is a commercially available meter which senses flow and temperature differential and automatically calculates and records watts. Meters must be capable of being read locally and by the base Energy Management and Control System (EMCS).

3.3.6. High-Temperature Water (HTW) Meters. If the facility is supplied HTW from a central plant, install a watt meter. This meter is similar to the chilled water meter, but suitable for the temperature and pressures incurred with HTW. Meters must be capable of being read locally and by the base EMCS.

3.3.7. Fuel Flow Meters. Refer to AFM 85-16, Maintenance of Petroleum Systems and NAVFAC DM 22, Petroleum Fuel Facilities.

3.3.8. Water and Wastewater Treatment Plant and Well Meters. Install meters for all plants and wells. Install flow-rate recording and totalizing meters in all plants treating more than 189,271 liters per day (0.05 MGD). Install totalizing meters in smaller plants. Components will meet these criteria:

- o Parshall flume - reinforced concrete with aluminum or reinforced fiberglass liner;
- o Nozzles - cast iron;
- o Weirs - brass alloy;
- o Magnetic - standard manufacturers product;
- o Control panel - standard manufacturers product (recording, indicating, and totalizing).

For wastewater treatment plant meters, refer to NAVFACENGCOM Guide Spec NFGS-13321, Flow Measuring Equipment (Potable Water) (Sewage Treatment Plant), 2 October 1985.

3.3.9. Heating Plant Meters- Provide the following instruments, meters, and auxiliaries:

3.3.9.1. Temperature Recorders: One for each high-temperature water boiler and each district heating circuit. Include meters on supply and return systems.

3.3.9.2. Recording and Integrating Flowmeters in Kilopascals (Pounds: One for each high-temperature water boiler and each district heating circuit.

3.3.9.3. Steam-Flow Meters: One recording and integrating type meter for each boiler using 87.9 kW (0.3 MBtu/h) or larger; or on a main header for a group of small boilers totaling 146.5 kW (0.5 MBtu/h) or more that allows recording pressure. Meters must be capable of being read locally and by the base EMCS. Turbine-type steam meters are not recommended. Refer to ANSI MFC-4M-86, Measurement of Gas Flow by Turbine Meters (R1990); MFC-5M-85, Measurement of Liquid Flow in Closed Conduits Using Transit-Time Ultrasonic Flowmeters; MFC-6M-87, Measurement of Fluid Flow in Pipes Using Vortex Flowmeters; MFC-11M-89, Measurement of Fluid Flow by Means of Coriolis Mass Flowmeters; and ASME PTC 19.5-72, Application Part II of Fluid Meters, sixth edition, 1971.

3.3.9.4. KWh (MBtu/h) Feedwater Meters: One for each high pressure boiler

plant 146.5 kW or larger not equipped with steam-flow meters.

3.3.9.5. CO₂, O₂, and Boiler Exit Temperature Recorders: One CO₂ or O₂ recording meter for each boiler 2931 to 13,188 kW (10 to 45 MBtu/h) output capacity. Provide boiler exit temperature on all boilers over 2931 kW.

3.3.10. Chilled Water Plant Meters. Install a temperature recorder at each plant. Provide flow recorders for constant and variable speed pumps, one for each chiller and each district chilled water circuit. Install meters on both supply and returns.

3.3.11. Make-Up Water Meters: One for each high-pressure steam and high-temperature water boiler plant.

3.3.12. Gas and Oil Meters: One for each boiler or direct-fired hot air furnace plant 879 kW (3 MBtu/h) or larger.

3.3.13. Temperature and Pressure Recorders: One for each feed water heater.

4. Definitions. New and renovated facilities include facilities which have not reached the 10 percent design stage as of the date of this letter. For this ETL, renovated facilities feature changes in the building envelope, replacement of lighting, HVAC, or water heating systems.

5. Point of Contact. Mr Freddie L. Beason, PE, HQ AFCESA/ENM, DSN 523-6361, commercial (904) 283-6361, FAX 523-6219.

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2. ETL Index

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ENGINEERING TECHNICAL LETTERS (ETL)

SECTION A - CURRENT ETLs

ETL Number	Title	Date Issued
82-2	Energy Efficient Equipment	10 Nov 82
83-1	Design of Control Systems for HVAC	16 Feb 83
	Change No. 1 ETL 83-1, U. S. Air Force	
	Standardized Heating, Ventilating & Air	
	Conditioning (HVAC) Control Systems	22 Jul 87
83-3	Interior Wiring Systems, AFM 88-15 Para 7-3	2 Mar 83
83-4	EMCS Data Transmission Media (DTM) Considerations	3 Apr 83
83-7	Plumbing, AFM 88-8, Chapter 4	30 Aug 83
83-8	Use of Air-to-Air Unitary Heat Pumps	15 Sep 83
83-9	Insulation	14 Nov 83
84-2	Computer Energy Analysis	27 Mar 84
	Change 1 Ref: HQ USAF/LEEEU Msg	
	031600Z MAY 84	1 Jun 84
84-7	MCP Energy Conservation Investment Program (ECIP)	13 Jun 84
84-10	Air Force Building Construction and	
	the Use of Termiticides	1 Aug 84
86-2	Energy Management and Control Systems (EMCS)	5 Feb 86
86-4	Paints and Protective Coatings	12 May 86
86-5	Fuels Use Criteria for Air Force Construction	22 May 86
86-8	Aqueous Film Forming Foam Waste Discharge Retention	
	and Disposal	4 Jun 86
86-9	Lodging Facility Design Guide	4 Jun 86
86-10	Antiterrorism Planning and Design Guidance	13 Jun 86
86-14	Solar Applications	15 Oct 86
86-16	Direct Digital Control Heating	
	Ventilation and Air Conditioning Systems	9 Dec 86
87-1	Lead Ban Requirements of Drinking Water	15 Jan 87
87-2	Volatile Organic Compounds	4 Mar 87
87-4	Energy Budget Figures (EBFS) for Facilities	
	in the Military Construction Program	13 Mar 87
87-9	Prewiring	21 Oct 87
88-2	Photovoltaic Applications	21 Jan 88
88-3	Design Standards for Critical Facilities	15 Jun 88
88-4	Reliability & Maintainability (R&M)	
	Design Checklist	24 Jun 88
88-6	Heat Distribution Systems Outside of Buildings	1 Aug 88
88-9	Radon Reduction in New Facility Construction	7 Oct 88
88-10	Prewired Workstations Guide Specification	29 Dec 88

ENGINEERING TECHNICAL LETTERS (ETL)

SECTION A - CURRENT ETLs

ETL Number	Title	Date Issued
89-2	Standard Guidelines for Submission of Facility Operating and Maintenance Manuals	23 May 89
89-3	Facility Fire Protection Criteria for Electronic Equipment Installations	9 Jun 89
89-4	Systems Furniture Guide Specification	6 Jul 89
89-6	Power Conditioning and Continuation Interfacing Equipment (PCCIE) in the Military Construction Program (MCP)	7 Sep 89
89-7	Design of Air Force Courtrooms	29 Sep 89
90-1	Built-Up Roof (BUR) Repair/Replacement Guide Specification	23 Jan 90
90-2	General Policy for Prewired Workstations and Systems Furniture	26 Jan 90
90-3	TEMPEST Protection for Facilities Change 1 Ref: HQ USAF/LEEDE Ltr dated 20 April 90, Same Subject	23 Mar 90
90-4	1990 Energy Prices and Discount Factors for Life-Cycle Cost Analysis	24 May 90
90-5	Fuel and Lube Oil Bulk Storage Capacity for Emergency Generators	26 Jul 90
90-6	Electrical System Grounding, Static Grounding and Lightning Protection	3 Oct 90
90-7	Air Force Interior Design Policy	12 Oct 90
90-8	Guide Specifications for Ethylene Propylene Diene Monomer (EPDM) Roofing	17 Oct 90
90-9	Fire Protection Engineering Criteria for Aircraft Maintenance, Servicing, and Storage Facilities	2 Nov 90
90-10	Commissioning of Heating, Ventilating, and Air Conditioning (HVAC) Systems Guide Specification	17 Oct 90
91-1	Fire Protection Engineering Criteria Testing Halon Fire Suppression Systems	2 Jan 91
91-2	High Altitude Electromagnetic Pulse (HEMP) Hardening in Facilities	4 Mar 91
91-4	Site Selection Criteria for Fire Protection Training Areas	14 Jun 91
91-5	Fire Protection Engineering Criteria - Emergency Lighting and Marking of Exits	18 Jun 91
91-6	Cathodic Protection	3 Jul 91

ENGINEERING TECHNICAL LETTERS (ETL)

SECTION A - CURRENT ETLs

ETL Number	Title	Date Issued
91-7	Chlorofluorocarbon (CFC) Limitation in Heating, Ventilating and Air-Conditioning (HVAC) Systems	21 Aug 91
93-1	Construction Signs	11 Mar 93
93-2	Dormitory Criteria for Humid Areas	13 Jul 93
93-3	Inventory, Screening, Prioritization, and Evaluation of Existing Buildings for Seismic Risk	18 Aug 93
93-4	Fire Protection Engineering Criteria - Automatic Sprinkler Systems in Military Family Housing (MFH)	11 Aug 93
93-5	Fire Protection Engineering Criteria - Electronic Equipment Installations	22 Dec 93
94-1	Standard Airfield Pavement Marking Schemes	5 Apr 94
94-2	Utility Meters in New and Renovated Facilities	10 Jun 94

SECTION B - OBSOLETE ETLs

No.	Date	Status
82-1	10 Nov 82	Superseded by ETL 83-10, 86-1, 87-4
82-3	10 Nov 82	Superseded by ETL 83-5, 84-2
82-4	10 Nov 82	Superseded by ETL 84-7
82-5	10 Nov 82	Superseded by ETL 84-1, 86-13, 86-14
82-6	30 Dec 82	Cancel led
82-7	30 Nov 82	Cancel led
83-2	16 Feb 83	Superseded by ETL 84-3
83-5	5 May 83	Superseded by ETL 84-2
83-6	24 May 83	Cancel led
83-10	28 Nov 83	Superseded by ETL 86-1
84-1	18 Jan 84	Superseded by ETL 86-14
84-3	21 Mar 84	Cancel led
84-4	10 Apr 84	Superseded by ETL 86-7, 86-15, 87-5
84-5	7 May 84	Superseded by ETL 84-8, 86-11, 86-18, 88-6
84-6	Not Issued	Cancel led/Not Used
84-8	19 Jun 84	Superseded by ETL 86-11
84-9	5 Jul 84	Superseded by ETL 88-7
88-5	2 Aug 88	Superseded by ETL 91-6
86-1	3 Feb 86	Superseded by ETL 87-7
86-3	21 Feb 86	Superseded by ETL 86-4
86-6	3 Jun 86	Superseded by ETL 86-11, 86-18, 88-6
86-7	3 Jun 86	Superseded by ETL 86-15
86-11	3 Jul 86	Superseded by ETL 88-6
86-12	3 Jul 86	Superseded by ETL 90-2
86-13	18 Aug 86	Superseded by ETL 86-14
86-15	13 Nov 86	Superseded by ETL 87-5
86-17	17 Dec 86	Superseded by ETL 89-6
86-18	18 Dec 86	Superseded by ETL 88-6
87-3	12 Mar 87	Superseded by ETL 87-6, ETL 88-6
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87-6	21 Aug 87	Superseded by ETL 88-5
87-7	14 Oct 87	Superseded by ETL 89-1
87-8	19 Oct 87	Superseded by ETL 90-1
88-1	5 Jan 88	Superseded by ETL 89-2
88-5	2 Aug 88	Superseded by ETL 91-6
88-7	24 Aug 88	Superseded by ETL 90-3, ETL 91-2
88-8	4 Oct 88	Superseded by ETL 91-7
89-1	6 Feb 89	Superseded by ETL 90-4
89-5		Issued as ETL 90-7
91-8	24 Sep 91	Cancel ed
91-3	14 Jun 91	Superseded by MIL HDBK 1008B, Jan 94